

SEQUENCE LISTING

<110> Schewe et al

<120> Monocotyledon plant cells and plants which synthesise modified starch

<130> 514413-3900

<140>

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<150> DE 10052492.3

<151> 2000-10-23

<150> DE 10064805.3

<151> 2000-12-22

<160> 16

<170> PatentIn Ver. 2.1

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<212> DNA

<213> Solanum tuberosum

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agctgaactt gagtgaatta agccagtggg aggat atg agt aat tcc tta ggg 233

Met Ser Asn Ser Leu Gly

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aat aac ttg ctg tac cag gga ttc cta acc tca aca gtg ttg gaa cat 281

Asn Asn Leu Leu Tyr Gln Gly Phe Leu Thr Ser Thr Val Leu Glu His

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aaa agt aga atc agt cct cct tgt gtt gga ggc aat tct ttg ttt caa 329

Lys Ser Arg Ile Ser Pro Pro Cys Val Gly Gly Asn Ser Leu Phe Gln

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caa caa gtg atc tcg aaa tca cct tta tca act gag ttt cga ggt aac 377

Gln Gln Val Ile Ser Lys Ser Pro Leu Ser Thr Glu Phe Arg Gly Asn

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agg tta aag gtg cag aaa aag aaa ata cct atg gga aag aac cgt gct 425

Arg Leu Lys Val Gln Lys Lys Lys Ile Pro Met Gly Lys Asn Arg Ala

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| ttt | tct | agt | tct | cct | cat | gct | gta | ctt | acc | act | gat | acc | tct | tct | gag | 473 |
| Phe | Ser | Ser | Ser | Pro | His | Ala | Val | Leu | Thr | Thr | Asp | Thr | Ser | Ser | Glu | |
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| cta | gca | gaa | aag | ttc | agt | cta | gaa | ggg | aat | att | gag | cta | cag | gtt | gat | 521 |
| Leu | Ala | Glu | Lys | Phe | Ser | Leu | Glu | Gly | Asn | Ile | Glu | Leu | Gln | Val | Asp | |
| | | | 90 | | | | | 95 | | | | | 100 | | | |
| gtt | agg | cct | ccc | act | tca | ggg | gat | gtg | tcc | ttt | gtg | gat | ttt | caa | gct | 569 |
| Val | Arg | Pro | Pro | Thr | Ser | Gly | Asp | Val | Ser | Phe | Val | Asp | Phe | Gln | Ala | |
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| aca | aat | ggg | agt | gat | aaa | ctg | ttt | ttg | cac | tgg | ggg | gca | gta | aag | ttc | 617 |
| Thr | Asn | Gly | Ser | Asp | Lys | Leu | Phe | Leu | His | Trp | Gly | Ala | Val | Lys | Phe | |
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| gga | aaa | gaa | aca | tgg | tct | ctt | cct | aat | gat | cgt | cca | gat | ggg | acc | aaa | 665 |
| Gly | Lys | Glu | Thr | Trp | Ser | Leu | Pro | Asn | Asp | Arg | Pro | Asp | Gly | Thr | Lys | |
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| gtg | tac | aag | aac | aaa | gca | ctt | aga | act | cca | ttt | gtt | aaa | tct | ggc | tct | 713 |
| Val | Tyr | Lys | Asn | Lys | Ala | Leu | Arg | Thr | Pro | Phe | Val | Lys | Ser | Gly | Ser | |
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| aac | tcc | atc | ctg | aga | ctg | gag | ata | cgg | gac | act | gct | atc | gaa | gct | att | 761 |
| Asn | Ser | Ile | Leu | Arg | Leu | Glu | Ile | Arg | Asp | Thr | Ala | Ile | Glu | Ala | Ile | |
| | | | 170 | | | | | 175 | | | | | 180 | | | |
| gag | ttt | ctc | ata | tac | gat | gaa | gcc | tac | gat | aaa | tgg | ata | aag | aat | aat | 809 |
| Glu | Phe | Leu | Ile | Tyr | Asp | Glu | Ala | Tyr | Asp | Lys | Trp | Ile | Lys | Asn | Asn | |
| | | 185 | | | | | 190 | | | | | 195 | | | | |
| ggg | ggc | aat | ttt | cgt | gtc | aaa | ttg | tca | aga | aaa | gag | ata | cga | ggc | cca | 857 |
| Gly | Gly | Asn | Phe | Arg | Val | Lys | Leu | Ser | Arg | Lys | Glu | Ile | Arg | Gly | Pro | |
| | 200 | | | | | 205 | | | | | 210 | | | | | |
| gat | gtt | tca | gtt | cct | gag | gag | ctt | gta | cag | atc | caa | tca | tat | ttg | agg | 905 |
| Asp | Val | Ser | Val | Pro | Glu | Glu | Leu | Val | Gln | Ile | Gln | Ser | Tyr | Leu | Arg | |
| 215 | | | | 220 | | | | | | 225 | | | | 230 | | |
| tgg | gag | agg | aag | gga | aaa | cag | aat | tac | acc | cct | gag | aaa | gag | aag | gag | 953 |
| Trp | Glu | Arg | Lys | Gly | Lys | Gln | Asn | Tyr | Thr | Pro | Glu | Lys | Glu | Lys | Glu | |
| | | | 235 | | | | | 240 | | | | | 245 | | | |
| gaa | tat | gag | gct | gct | cga | act | gag | cta | cag | gag | gaa | ata | gct | cgt | ggg | 1001 |
| Glu | Tyr | Glu | Ala | Ala | Arg | Thr | Glu | Leu | Gln | Glu | Glu | Ile | Ala | Arg | Gly | |
| | | | 250 | | | | | 255 | | | | | 260 | | | |
| gct | tcc | ata | cag | gac | att | cga | gca | agg | cta | aca | aaa | act | aat | gat | aaa | 1049 |
| Ala | Ser | Ile | Gln | Asp | Ile | Arg | Ala | Arg | Leu | Thr | Lys | Thr | Asn | Asp | Lys | |
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| agt | caa | agc | aaa | gaa | gag | cct | ctt | cat | gta | aca | aag | agt | gaa | ata | cct | 1097 |
| Ser | Gln | Ser | Lys | Glu | Glu | Pro | Leu | His | Val | Thr | Lys | Ser | Glu | Ile | Pro | |
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|---|------|
| atg cca ttt gtt ctt ttg tct ggt gaa aaa tgg att aag aac caa ggg | 1817 |
| Met Pro Phe Val Leu Leu Ser Gly Glu Lys Trp Ile Lys Asn Gln Gly | |
| 520 525 530 | |
| tcg gat ttc tat gtt gac ttc agt gct gca tcc aaa tta gca ctc aag | 1865 |
| Ser Asp Phe Tyr Val Asp Phe Ser Ala Ala Ser Lys Leu Ala Leu Lys | |
| 535 540 545 550 | |
| gct gct ggg gat ggc agt gga act gca aag tct tta ctg gat aaa ata | 1913 |
| Ala Ala Gly Asp Gly Ser Gly Thr Ala Lys Ser Leu Leu Asp Lys Ile | |
| 555 560 565 | |
| gca gat atg gaa agt gag gct cag aag tca ttt atg cac cgg ttt aat | 1961 |
| Ala Asp Met Glu Ser Glu Ala Gln Lys Ser Phe Met His Arg Phe Asn | |
| 570 575 580 | |
| att gct gct gac ttg ata gaa gat gcc act agt gct ggt gaa ctt ggt | 2009 |
| Ile Ala Ala Asp Leu Ile Glu Asp Ala Thr Ser Ala Gly Glu Leu Gly | |
| 585 590 595 | |
| ttt act gga att ctt gta tgg atg agg ttc atg gct aca agg caa ctg | 2057 |
| Phe Thr Gly Ile Leu Val Trp Met Arg Phe Met Ala Thr Arg Gln Leu | |
| 600 605 610 | |
| ata tgg aac aaa aac tat aac gta aaa cca cgt gaa ata agc aag gct | 2105 |
| Ile Trp Asn Lys Asn Tyr Asn Val Lys Pro Arg Glu Ile Ser Lys Ala | |
| 615 620 625 630 | |
| cag gac aga ctt aca gac ttg ttg cag aat gct ttc acc agt cac cct | 2153 |
| Gln Asp Arg Leu Thr Asp Leu Leu Gln Asn Ala Phe Thr Ser His Pro | |
| 635 640 645 | |
| caa tac cgt gaa att ttg cgg atg att atg tca act gtt gga cgt gga | 2201 |
| Gln Tyr Arg Glu Ile Leu Arg Met Ile Met Ser Thr Val Gly Arg Gly | |
| 650 655 660 | |
| ggt gaa ggg gat gta gga cag cga att agg gat gaa att ttg gtc atc | 2249 |
| Gly Glu Gly Asp Val Gly Gln Arg Ile Arg Asp Glu Ile Leu Val Ile | |
| 665 670 675 | |
| cag agg aaa aat gac tgc aag ggt ggt atg atg gaa gaa tgg cat cag | 2297 |
| Gln Arg Lys Asn Asp Cys Lys Gly Gly Met Met Glu Glu Trp His Gln | |
| 680 685 690 | |
| aaa ttg cat aat aat act agt cct gat gat gtt gtg atc tgt cag gca | 2345 |
| Lys Leu His Asn Asn Thr Ser Pro Asp Asp Val Val Ile Cys Gln Ala | |
| 695 700 705 710 | |
| ttg att gac tac atc aag agt gat ttt gat ctt ggt gtt tat tgg aaa | 2393 |
| Leu Ile Asp Tyr Ile Lys Ser Asp Phe Asp Leu Gly Val Tyr Trp Lys | |
| 715 720 725 | |
| acc ctg aat gag aac gga ata aca aaa gag cgt ctt ttg agt tat gac | 2441 |
| Thr Leu Asn Glu Asn Gly Ile Thr Lys Glu Arg Leu Leu Ser Tyr Asp | |
| 730 735 740 | |

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|---|------|
| cgt gct atc cat tct gaa ccg aat ttt aga gga gat caa aag aat ggt | 2489 |
| Arg Ala Ile His Ser Glu Pro Asn Phe Arg Gly Asp Gln Lys Asn Gly | |
| 745 750 755 | |
| ctt ttg cgt gat tta ggt cac tat atg aga aca ttg aag gct gtt cat | 2537 |
| Leu Leu Arg Asp Leu Gly His Tyr Met Arg Thr Leu Lys Ala Val His | |
| 760 765 770 | |
| tca ggt gca gat ctt gag tct gct att gca aac tgc atg ggc tac aaa | 2585 |
| Ser Gly Ala Asp Leu Glu Ser Ala Ile Ala Asn Cys Met Gly Tyr Lys | |
| 775 780 785 790 | |
| act gag gga gaa ggc ttt atg gtt gga gtc cag ata aat cct gta tca | 2633 |
| Thr Glu Gly Glu Gly Phe Met Val Gly Val Gln Ile Asn Pro Val Ser | |
| 795 800 805 | |
| ggc ttg cca tct ggc ttt cag ggc ctc ctc cat ttt gtc tta gac cat | 2681 |
| Gly Leu Pro Ser Gly Phe Gln Gly Leu Leu His Phe Val Leu Asp His | |
| 810 815 820 | |
| gtg gaa gat aaa aat gtg gaa act ctt ctt gag gga ttg cta gag gct | 2729 |
| Val Glu Asp Lys Asn Val Glu Thr Leu Leu Glu Gly Leu Leu Glu Ala | |
| 825 830 835 | |
| cgt gag gag ctt agg ccc ttg ctt ctc aaa cca aac aac cgt cta aag | 2777 |
| Arg Glu Glu Leu Arg Pro Leu Leu Leu Lys Pro Asn Asn Arg Leu Lys | |
| 840 845 850 | |
| gat ctg ctg ttt ttg gac ata gca ctt gat tct aca gtt aga aca gca | 2825 |
| Asp Leu Leu Phe Leu Asp Ile Ala Leu Asp Ser Thr Val Arg Thr Ala | |
| 855 860 865 870 | |
| gta gaa agg gga tat gaa gaa ttg aac aac gct aat cct gag aaa atc | 2873 |
| Val Glu Arg Gly Tyr Glu Glu Leu Asn Asn Ala Asn Pro Glu Lys Ile | |
| 875 880 885 | |
| atg tac ttc atc tcc ctc gtt ctt gaa aat ctc gca ctc tct gtg gac | 2921 |
| Met Tyr Phe Ile Ser Leu Val Leu Glu Asn Leu Ala Leu Ser Val Asp | |
| 890 895 900 | |
| gat aat gaa gat ctt gtt tat tgc ttg aag gga tgg aat caa gct ctt | 2969 |
| Asp Asn Glu Asp Leu Val Tyr Cys Leu Lys Gly Trp Asn Gln Ala Leu | |
| 905 910 915 | |
| tca atg tcc aat ggt gga gac aac cat tgg gct tta ttt gca aaa gct | 3017 |
| Ser Met Ser Asn Gly Gly Asp Asn His Trp Ala Leu Phe Ala Lys Ala | |
| 920 925 930 | |
| gta ctt gac aga atc cgt ctt gca ctt gca agc aag gca gag tgg tac | 3065 |
| Val Leu Asp Arg Ile Arg Leu Ala Leu Ala Ser Lys Ala Glu Trp Tyr | |
| 935 940 945 950 | |
| cat cac tta ttg cag cca tct gcc gaa tat cta gga tca atc ctt ggg | 3113 |
| His His Leu Leu Gln Pro Ser Ala Glu Tyr Leu Gly Ser Ile Leu Gly | |
| 955 960 965 | |

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|-----|------|------|------|-----|------|------|------|------|------|------|------|------|------|-----|------|------|
| gtg | gac | caa | tgg | gct | ttg | aac | ata | ttt | act | gaa | gaa | att | ata | cgt | gct | 3161 |
| Val | Asp | Gln | Trp | Ala | Leu | Asn | Ile | Phe | Thr | Glu | Glu | Ile | Ile | Arg | Ala | |
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| gga | tca | gca | gct | tca | tta | tcc | tct | ctt | ctt | aat | aga | ctc | gat | ccc | gtg | 3209 |
| Gly | Ser | Ala | Ala | Ser | Leu | Ser | Ser | Leu | Leu | Asn | Arg | Leu | Asp | Pro | Val | |
| | | 985 | | | | | 990 | | | | | 995 | | | | |
| ctt | cgg | aaa | act | gca | aat | cta | gga | agt | tgg | cag | att | atc | agt | cca | gtt | 3257 |
| Leu | Arg | Lys | Thr | Ala | Asn | Leu | Gly | Ser | Trp | Gln | Ile | Ile | Ser | Pro | Val | |
| | 1000 | | | | | 1005 | | | | | 1010 | | | | | |
| gaa | gcc | gtt | gga | tat | gtt | gtc | gtt | gtg | gat | gag | ttg | ctt | tca | gtt | cag | 3305 |
| Glu | Ala | Val | Gly | Tyr | Val | Val | Val | Val | Asp | Glu | Leu | Leu | Ser | Val | Gln | |
| | 1015 | | | | 1020 | | | | 1025 | | | | | | 1030 | |
| aat | gaa | atc | tac | aag | aag | ccc | acg | atc | tta | gta | gca | aac | tct | gtt | aaa | 3353 |
| Asn | Glu | Ile | Tyr | Lys | Lys | Pro | Thr | Ile | Leu | Val | Ala | Asn | Ser | Val | Lys | |
| | | | 1035 | | | | | 1040 | | | | | 1045 | | | |
| gga | gag | gag | gaa | att | cct | gat | ggt | gct | gtt | gcc | ctg | ata | aca | cca | gac | 3401 |
| Gly | Glu | Glu | Glu | Ile | Pro | Asp | Gly | Ala | Val | Ala | Leu | Ile | Thr | Pro | Asp | |
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| atg | cca | gat | gtt | ctt | tca | cat | gtt | tct | gtt | cga | gct | aga | aat | ggg | aag | 3449 |
| Met | Pro | Asp | Val | Leu | Ser | His | Val | Ser | Val | Arg | Ala | Arg | Asn | Gly | Lys | |
| | 1065 | | | | | 1070 | | | | | 1075 | | | | | |
| gtt | tgc | ttt | gct | aca | tgc | ttt | gat | ccc | aat | ata | ttg | gct | gac | ctc | caa | 3497 |
| Val | Cys | Phe | Ala | Thr | Cys | Phe | Asp | Pro | Asn | Ile | Leu | Ala | Asp | Leu | Gln | |
| | 1080 | | | | | 1085 | | | | | 1090 | | | | | |
| gca | aag | gaa | gga | agg | att | ttg | ctc | tta | aag | cct | aca | cct | tca | gac | ata | 3545 |
| Ala | Lys | Glu | Gly | Arg | Ile | Leu | Leu | Leu | Lys | Pro | Thr | Pro | Ser | Asp | Ile | |
| | 1095 | | | | 1100 | | | | | 1105 | | | | | 1110 | |
| atc | tat | agt | gag | gtg | aat | gag | att | gag | ctc | caa | agt | tca | agt | aac | ttg | 3593 |
| Ile | Tyr | Ser | Glu | Val | Asn | Glu | Ile | Glu | Leu | Gln | Ser | Ser | Ser | Asn | Leu | |
| | | | 1115 | | | | | 1120 | | | | | 1125 | | | |
| gta | gaa | gct | gaa | act | tca | gca | aca | ctt | aga | ttg | gtg | aaa | aag | caa | ttt | 3641 |
| Val | Glu | Ala | Glu | Thr | Ser | Ala | Thr | Leu | Arg | Leu | Val | Lys | Lys | Gln | Phe | |
| | | 1130 | | | | | 1135 | | | | | 1140 | | | | |
| ggt | ggt | tgt | tac | gca | ata | tca | gca | gat | gaa | ttc | aca | agt | gaa | atg | gtt | 3689 |
| Gly | Gly | Cys | Tyr | Ala | Ile | Ser | Ala | Asp | Glu | Phe | Thr | Ser | Glu | Met | Val | |
| | 1145 | | | | | 1150 | | | | | 1155 | | | | | |
| gga | gct | aaa | tca | cgt | aat | att | gca | tat | ctg | aaa | gga | aaa | gtg | cct | tcc | 3737 |
| Gly | Ala | Lys | Ser | Arg | Asn | Ile | Ala | Tyr | Leu | Lys | Gly | Lys | Val | Pro | Ser | |
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| tcg | gtg | gga | att | | | | | | | | | | | | | |

| | |
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| aaa gta ctt tca gac gac ata aat cag gga gtg gca aaa gag ttg caa | 3833 |
| Lys Val Leu Ser Asp Asp Ile Asn Gln Gly Val Ala Lys Glu Leu Gln | |
| 1195 1200 1205 | |
| att ctg acg aaa aaa cta tct gaa gga gac ttc agc gct ctt ggt gaa | 3881 |
| Ile Leu Thr Lys Lys Leu Ser Glu Gly Asp Phe Ser Ala Leu Gly Glu | |
| 1210 1215 1220 | |
| att cgc aca acg att tta gat ctt tca gca cca gct caa ttg gtc aaa | 3929 |
| Ile Arg Thr Thr Ile Leu Asp Leu Ser Ala Pro Ala Gln Leu Val Lys | |
| 1225 1230 1235 | |
| gag ctg aag gaa aag atg cag ggt tct ggc atg cct tgg cct ggt gat | 3977 |
| Glu Leu Lys Glu Lys Met Gln Gly Ser Gly Met Pro Trp Pro Gly Asp | |
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| gaa ggt cca aag cgg tgg gaa caa gca tgg atg gcc ata aaa aag gtg | 4025 |
| Glu Gly Pro Lys Arg Trp Glu Gln Ala Trp Met Ala Ile Lys Lys Val | |
| 1255 1260 1265 1270 | |
| tgg gct tca aaa tgg aat gag aga gca tac ttc agc aca agg aag gtg | 4073 |
| Trp Ala Ser Lys Trp Asn Glu Arg Ala Tyr Phe Ser Thr Arg Lys Val | |
| 1275 1280 1285 | |
| aaa ctg gat cat gac tat ctg tgc atg gct gtc ctt gtt caa gaa ata | 4121 |
| Lys Leu Asp His Asp Tyr Leu Cys Met Ala Val Leu Val Gln Glu Ile | |
| 1290 1295 1300 | |
| ata aat gct gat tat gca ttt gtc att cac aca acc aac cca tct tcc | 4169 |
| Ile Asn Ala Asp Tyr Ala Phe Val Ile His Thr Thr Asn Pro Ser Ser | |
| 1305 1310 1315 | |
| gga gac gac tca gaa ata tat gcc gag gtg gtc agg ggc ctt ggg gaa | 4217 |
| Gly Asp Asp Ser Glu Ile Tyr Ala Glu Val Val Arg Gly Leu Gly Glu | |
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| aca ctt gtt gga gct tac cca gga cgt gct ttg agt ttt atc tgc aag | 4265 |
| Thr Leu Val Gly Ala Tyr Pro Gly Arg Ala Leu Ser Phe Ile Cys Lys | |
| 1335 1340 1345 1350 | |
| aaa aag gat ctc aac tct cct caa gtg tta ggt tac cca agc aaa ccg | 4313 |
| Lys Lys Asp Leu Asn Ser Pro Gln Val Leu Gly Tyr Pro Ser Lys Pro | |
| 1355 1360 1365 | |
| atc ggc ctt ttc ata aaa aga tct atc atc ttc cga tct gat tcc aat | 4361 |
| Ile Gly Leu Phe Ile Lys Arg Ser Ile Ile Phe Arg Ser Asp Ser Asn | |
| 1370 1375 1380 | |
| ggg gaa gat ttg gaa ggt tat gcc ggt gct ggc ctc tac gac agt gta | 4409 |
| Gly Glu Asp Leu Glu Gly Tyr Ala Gly Ala Gly Leu Tyr Asp Ser Val | |
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| cca atg gat gag gag gaa aaa gtt gta att gat tac tct tcc gac cca | 4457 |
| Pro Met Asp Glu Glu Glu Lys Val Val Ile Asp Tyr Ser Ser Asp Pro | |
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 Glu Gly Val Val Arg Asp Gly Lys Ile Tyr Val Val Gln Thr Arg Pro
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 Thr Glu Phe Arg Gly Asn Arg Leu Lys Val Gln Lys Lys Lys Ile Pro
 50 55 60
 Met Gly Lys Asn Arg Ala Phe Ser Ser Ser Pro His Ala Val Leu Thr
 65 70 75 80
 Thr Asp Thr Ser Ser Glu Leu Ala Glu Lys Phe Ser Leu Glu Gly Asn
 85 90 95
 Ile Glu Leu Gln Val Asp Val Arg Pro Pro Thr Ser Gly Asp Val Ser
 100 105 110

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Phe | Val | Asp | Phe | Gln | Ala | Thr | Asn | Gly | Ser | Asp | Lys | Leu | Phe | Leu | His |
| | | 115 | | | | | 120 | | | | | 125 | | | |
| Trp | Gly | Ala | Val | Lys | Phe | Gly | Lys | Glu | Thr | Trp | Ser | Leu | Pro | Asn | Asp |
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| Arg | Pro | Asp | Gly | Thr | Lys | Val | Tyr | Lys | Asn | Lys | Ala | Leu | Arg | Thr | Pro |
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| Phe | Val | Lys | Ser | Gly | Ser | Asn | Ser | Ile | Leu | Arg | Leu | Glu | Ile | Arg | Asp |
| | | | | 165 | | | | | 170 | | | | | 175 | |
| Thr | Ala | Ile | Glu | Ala | Ile | Glu | Phe | Leu | Ile | Tyr | Asp | Glu | Ala | Tyr | Asp |
| | | | 180 | | | | | 185 | | | | | 190 | | |
| Lys | Trp | Ile | Lys | Asn | Asn | Gly | Gly | Asn | Phe | Arg | Val | Lys | Leu | Ser | Arg |
| | | 195 | | | | 200 | | | | | | 205 | | | |
| Lys | Glu | Ile | Arg | Gly | Pro | Asp | Val | Ser | Val | Pro | Glu | Glu | Leu | Val | Gln |
| | 210 | | | | | 215 | | | | | 220 | | | | |
| Ile | Gln | Ser | Tyr | Leu | Arg | Trp | Glu | Arg | Lys | Gly | Lys | Gln | Asn | Tyr | Thr |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 |
| Pro | Glu | Lys | Glu | Lys | Glu | Glu | Tyr | Glu | Ala | Ala | Arg | Thr | Glu | Leu | Gln |
| | | | | 245 | | | | | 250 | | | | | 255 | |
| Glu | Glu | Ile | Ala | Arg | Gly | Ala | Ser | Ile | Gln | Asp | Ile | Arg | Ala | Arg | Leu |
| | | | 260 | | | | | 265 | | | | | 270 | | |
| Thr | Lys | Thr | Asn | Asp | Lys | Ser | Gln | Ser | Lys | Glu | Glu | Pro | Leu | His | Val |
| | | 275 | | | | | 280 | | | | | 285 | | | |
| Thr | Lys | Ser | Glu | Ile | Pro | Asp | Asp | Leu | Ala | Gln | Ala | Gln | Ala | Tyr | Ile |
| | 290 | | | | | 295 | | | | | 300 | | | | |
| Arg | Trp | Glu | Lys | Ala | Gly | Lys | Pro | Asn | Tyr | Pro | Pro | Glu | Lys | Gln | Ile |
| 305 | | | | | 310 | | | | | 315 | | | | | 320 |
| Glu | Glu | Leu | Glu | Glu | Ala | Arg | Arg | Glu | Leu | Gln | Leu | Glu | Leu | Glu | Lys |
| | | | | 325 | | | | | 330 | | | | | 335 | |
| Gly | Ile | Thr | Leu | Asp | Glu | Leu | Arg | Lys | Lys | Ile | Thr | Lys | Gly | Glu | Ile |
| | | | 340 | | | | | 345 | | | | | 350 | | |
| Lys | Thr | Lys | Ala | Glu | Lys | His | Val | Lys | Arg | Ser | Ser | Phe | Ala | Val | Glu |
| | | 355 | | | | | 360 | | | | | 365 | | | |
| Arg | Ile | Gln | Arg | Lys | Lys | Arg | Asp | Phe | Gly | Gln | Leu | Ile | Asn | Lys | Tyr |
| | 370 | | | | | 375 | | | | | 380 | | | | |
| Pro | Ser | Ser | Pro | Ala | Val | Gln | Val | Gln | Lys | Val | Leu | Glu | Glu | Pro | Pro |
| 385 | | | | | 390 | | | | | 395 | | | | | 400 |
| Ala | Leu | Ser | Lys | Ile | Lys | Leu | Tyr | Ala | Lys | Glu | Lys | Glu | Glu | Gln | Ile |

| | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| | | | | 405 | | | | | 410 | | | | | 415 | | | |
| Asp | Asp | Pro | Ile | Leu | Asn | Lys | Lys | Ile | Phe | Lys | Val | Asp | Asp | Gly | Glu | | |
| | | | 420 | | | | | 425 | | | | | 430 | | | | |
| Leu | Leu | Val | Leu | Val | Ala | Lys | Ser | Ser | Gly | Lys | Thr | Lys | Val | His | Ile | | |
| | | 435 | | | | | 440 | | | | | 445 | | | | | |
| Ala | Thr | Asp | Leu | Asn | Gln | Pro | Ile | Thr | Leu | His | Trp | Ala | Leu | Ser | Lys | | |
| | 450 | | | | | 455 | | | | | 460 | | | | | | |
| Ser | Arg | Gly | Glu | Trp | Met | Val | Pro | Pro | Ser | Ser | Ile | Leu | Pro | Pro | Gly | | |
| 465 | | | | | 470 | | | | | 475 | | | | | 480 | | |
| Ser | Ile | Ile | Leu | Asp | Lys | Ala | Ala | Glu | Thr | Pro | Phe | Ser | Ala | Ser | Ser | | |
| | | | | 485 | | | | 490 | | | | | | 495 | | | |
| Ser | Asp | Gly | Leu | Thr | Ser | Lys | Val | Gln | Ser | Leu | Asp | Ile | Val | Ile | Glu | | |
| | | | 500 | | | | | 505 | | | | | 510 | | | | |
| Asp | Gly | Asn | Phe | Val | Gly | Met | Pro | Phe | Val | Leu | Leu | Ser | Gly | Glu | Lys | | |
| | | 515 | | | | | 520 | | | | | 525 | | | | | |
| Trp | Ile | Lys | Asn | Gln | Gly | Ser | Asp | Phe | Tyr | Val | Asp | Phe | Ser | Ala | Ala | | |
| | 530 | | | | | 535 | | | | | 540 | | | | | | |
| Ser | Lys | Leu | Ala | Leu | Lys | Ala | Ala | Gly | Asp | Gly | Ser | Gly | Thr | Ala | Lys | | |
| 545 | | | | | 550 | | | | | 555 | | | | | 560 | | |
| Ser | Leu | Leu | Asp | Lys | Ile | Ala | Asp | Met | Glu | Ser | Glu | Ala | Gln | Lys | Ser | | |
| | | | | 565 | | | | | 570 | | | | | 575 | | | |
| Phe | Met | His | Arg | Phe | Asn | Ile | Ala | Ala | Asp | Leu | Ile | Glu | Asp | Ala | Thr | | |
| | | | 580 | | | | | 585 | | | | | 590 | | | | |
| Ser | Ala | Gly | Glu | Leu | Gly | Phe | Thr | Gly | Ile | Leu | Val | Trp | Met | Arg | Phe | | |
| | | 595 | | | | | 600 | | | | | 605 | | | | | |
| Met | Ala | Thr | Arg | Gln | Leu | Ile | Trp | Asn | Lys | Asn | Tyr | Asn | Val | Lys | Pro | | |
| | 610 | | | | | 615 | | | | | 620 | | | | | | |
| Arg | Glu | Ile | Ser | Lys | Ala | Gln | Asp | Arg | Leu | Thr | Asp | Leu | Leu | Gln | Asn | | |
| 625 | | | | | 630 | | | | | 635 | | | | | 640 | | |
| Ala | Phe | Thr | Ser | His | Pro | Gln | Tyr | Arg | Glu | Ile | Leu | Arg | Met | Ile | Met | | |
| | | | | 645 | | | | | 650 | | | | | 655 | | | |
| Ser | Thr | Val | Gly | Arg | Gly | Gly | Glu | Gly | Asp | Val | Gly | Gln | Arg | Ile | Arg | | |
| | | | 660 | | | | | 665 | | | | | | 670 | | | |
| Asp | Glu | Ile | Leu | Val | Ile | Gln | Arg | Lys | Asn | Asp | Cys | Lys | Gly | Gly | Met | | |
| | | 675 | | | | | 680 | | | | | 685 | | | | | |
| Met | Glu | Glu | Trp | His | Gln | Lys | Leu | His | Asn | Asn | Thr | Ser | Pro | Asp | Asp | | |
| | 690 | | | | | 695 | | | | | 700 | | | | | | |

| | | | | | | | | | | | | | | | |
|------------|------------|------------|------------|------------|------------|------------|------------|-------------|------------|------------|-------------|------------|------------|------------|------------|
| Val 705 | Val | Ile | Cys | Gln | Ala 710 | Leu | Ile | Asp | Tyr | Ile 715 | Lys | Ser | Asp | Phe | Asp 720 |
| Leu | Gly | Val | Tyr | Trp 725 | Lys | Thr | Leu | Asn | Glu 730 | Asn | Gly | Ile | Thr | Lys 735 | Glu |
| Arg | Leu | Leu | Ser 740 | Tyr | Asp | Arg | Ala | Ile 745 | His | Ser | Glu | Pro | Asn 750 | Phe | Arg |
| Gly | Asp | Gln 755 | Lys | Asn | Gly | Leu | Leu 760 | Arg | Asp | Leu | Gly | His 765 | Tyr | Met | Arg |
| Thr 770 | Leu | Lys | Ala | Val | His | Ser 775 | Gly | Ala | Asp | Leu | Glu 780 | Ser | Ala | Ile | Ala |
| Asn 785 | Cys | Met | Gly | Tyr | Lys 790 | Thr | Glu | Gly | Glu | Gly 795 | Phe | Met | Val | Gly | Val 800 |
| Gln | Ile | Asn | Pro 805 | Val | Ser | Gly | Leu | Pro | Ser 810 | Gly | Phe | Gln | Gly | Leu 815 | Leu |
| His | Phe | Val | Leu 820 | Asp | His | Val | Glu | Asp 825 | Lys | Asn | Val | Glu | Thr 830 | Leu | Leu |
| Glu | Gly 835 | Leu | Leu | Glu | Ala | Arg | Glu 840 | Glu | Leu | Arg | Pro | Leu 845 | Leu | Leu | Lys |
| Pro 850 | Asn | Asn | Arg | Leu | Lys | Asp 855 | Leu | Leu | Phe | Leu | Asp 860 | Ile | Ala | Leu | Asp |
| Ser 865 | Thr | Val | Arg | Thr | Ala 870 | Val | Glu | Arg | Gly | Tyr 875 | Glu | Glu | Leu | Asn | Asn 880 |
| Ala | Asn | Pro | Glu 885 | Lys | Ile | Met | Tyr | Phe | Ile 890 | Ser | Leu | Val | Leu | Glu 895 | Asn |
| Leu | Ala | Leu | Ser 900 | Val | Asp | Asp | Asn | Glu | Asp 905 | Leu | Val | Tyr | Cys 910 | Leu | Lys |
| Gly | Trp 915 | Asn | Gln | Ala | Leu | Ser | Met 920 | Ser | Asn | Gly | Gly | Asp 925 | Asn | His | Trp |
| Ala 930 | Leu | Phe | Ala | Lys | Ala | Val 935 | Leu | Asp | Arg | Ile | Arg 940 | Leu | Ala | Leu | Ala |
| Ser 945 | Lys | Ala | Glu | Trp | Tyr 950 | His | His | Leu | Leu | Gln 955 | Pro | Ser | Ala | Glu | Tyr 960 |
| Leu | Gly | Ser | Ile 965 | Leu | Gly | Val | Asp | Gln | Trp 970 | Ala | Leu | Asn | Ile | Phe 975 | Thr |
| Glu | Glu | Ile 980 | Ile | Arg | Ala | Gly | Ser | Ala 985 | Ala | Ser | Leu | Ser | Ser 990 | Leu | Leu |
| Asn | Arg 995 | Leu | Asp | Pro | Val | Leu | Arg | Lys 1000 | Thr | Ala | Asn 1005 | Leu | Gly | Ser | Trp |

Gln Ile Ile Ser Pro Val Glu Ala Val Gly Tyr Val Val Val Val Asp
1010 1015 1020

Glu Leu Leu Ser Val Gln Asn Glu Ile Tyr Lys Lys Pro Thr Ile Leu
1025 1030 1035 1040

Val Ala Asn Ser Val Lys Gly Glu Glu Glu Ile Pro Asp Gly Ala Val
1045 1050 1055

Ala Leu Ile Thr Pro Asp Met Pro Asp Val Leu Ser His Val Ser Val
1060 1065 1070

Arg Ala Arg Asn Gly Lys Val Cys Phe Ala Thr Cys Phe Asp Pro Asn
1075 1080 1085

Ile Leu Ala Asp Leu Gln Ala Lys Glu Gly Arg Ile Leu Leu Leu Lys
1090 1095 1100

Pro Thr Pro Ser Asp Ile Ile Tyr Ser Glu Val Asn Glu Ile Glu Leu
1105 1110 1115 1120

Gln Ser Ser Ser Asn Leu Val Glu Ala Glu Thr Ser Ala Thr Leu Arg
1125 1130 1135

Leu Val Lys Lys Gln Phe Gly Gly Cys Tyr Ala Ile Ser Ala Asp Glu
1140 1145 1150

Phe Thr Ser Glu Met Val Gly Ala Lys Ser Arg Asn Ile Ala Tyr Leu
1155 1160 1165

Lys Gly Lys Val Pro Ser Ser Val Gly Ile Pro Thr Ser Val Ala Leu
1170 1175 1180

Pro Phe Gly Val Phe Glu Lys Val Leu Ser Asp Asp Ile Asn Gln Gly
1185 1190 1195 1200

Val Ala Lys Glu Leu Gln Ile Leu Thr Lys Lys Leu Ser Glu Gly Asp
1205 1210 1215

Phe Ser Ala Leu Gly Glu Ile Arg Thr Thr Ile Leu Asp Leu Ser Ala
1220 1225 1230

Pro Ala Gln Leu Val Lys Glu Leu Lys Glu Lys Met Gln Gly Ser Gly
1235 1240 1245

Met Pro Trp Pro Gly Asp Glu Gly Pro Lys Arg Trp Glu Gln Ala Trp
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Met Ala Ile Lys Lys Val Trp Ala Ser Lys Trp Asn Glu Arg Ala Tyr
1265 1270 1275 1280

Phe Ser Thr Arg Lys Val Lys Leu Asp His Asp Tyr Leu Cys Met Ala
1285 1290 1295

Val Leu Val Gln Glu Ile Ile Asn Ala Asp Tyr Ala Phe Val Ile His
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Thr Thr Asn Pro Ser Ser Gly Asp Asp Ser Glu Ile Tyr Ala Glu Val
1315 1320 1325

Val Arg Gly Leu Gly Glu Thr Leu Val Gly Ala Tyr Pro Gly Arg Ala
1330 1335 1340

Leu Ser Phe Ile Cys Lys Lys Lys Asp Leu Asn Ser Pro Gln Val Leu
1345 1350 1355 1360

Gly Tyr Pro Ser Lys Pro Ile Gly Leu Phe Ile Lys Arg Ser Ile Ile
1365 1370 1375

Phe Arg Ser Asp Ser Asn Gly Glu Asp Leu Glu Gly Tyr Ala Gly Ala
1380 1385 1390

Gly Leu Tyr Asp Ser Val Pro Met Asp Glu Glu Glu Lys Val Val Ile
1395 1400 1405

Asp Tyr Ser Ser Asp Pro Leu Ile Thr Asp Gly Asn Phe Arg Gln Thr
1410 1415 1420

Ile Leu Ser Asn Ile Ala Arg Ala Gly His Ala Ile Glu Glu Leu Tyr
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Gly Ser Pro Gln Asp Ile Glu Gly Val Val Arg Asp Gly Lys Ile Tyr
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Val Val Gln Thr Arg Pro Gln Met
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